REMARKS

Claims 1, 3, 6, 7 and 11 to 13 remain in the present application. No claims have been amended by this Response.

Reconsideration of the Examiner's decisions and reexamination of this application are respectfully requested. Entry of this Response is respectfully requested as no claims are amended and it places the application in condition for allowance.

The §103 rejections:

I. Claims 1, 3, 11 and 12 have been rejected by the Examiner under 35 USC §103(a) as being unpatentable over Applicants' Prior Art in view of Werkhoven et al. U.S. Patent Application Publication 2003/0032281 (hereafter Werkhoven).

In the Examiner's rejection, the Examiner indicated that Applicants' Prior Art discloses all the limitations except for the liner layer to have a thickness of 2 nm or less.

This conclusion is submitted to be erroneous.

The Examiner goes on to state that in "regards to the substantially uniform chemical composition and the failure temperature greater than 730 degrees Centigrade, these limitations are product by process limitations."

This conclusion is submitted also to be erroneous.

What Applicants are claiming here is not merely a liner thickness, or a tantalum / nitrogen ratio or a failure temperature. Rather, Applicants are claiming an interconnect structure in which the liner layer may be customized as taught in Applicants' specification. The thickness of the liner layer may be made thinner for higher nitrogen

contents to achieve a failure temperature greater than 730 degrees Centigrade for small groundrule (say 45nm or less) structures. On the other hand, the liner layer may be made thicker for lower nitrogen contents to also achieve a failure temperature greater than 730 degrees Centigrade for large groundrule (say 65nm and above) structures. This kind of relationship is not taught in the prior art.

Taking claim 1 first, some of the important elements of the claim are "at least one liner layer having a substantially uniform chemical composition", "said at least one liner...having a thickness of less than 4 nm", a ratio of tantalum and nitrogen "less than 1.5 N:Ta and greater than 1.2" and the liner material having a "failure temperature greater than 730 degrees Centigrade".

Regarding the ratio of tantalum and nitrogen, it is believed that the Examiner recognizes that the prior art does not show the ratio claimed by Applicants. That the ratios are not identical to the prior art, or even overlap the prior art, is evidenced by the Cabral Declaration. Thus, the Examiner's statement that "Applicant's Prior Art discloses all the limitations except for the liner layer to have a thickness of 2nm or less" is erroneous. In regards to the Titanium Metals Corp. of America case cited by the Examiner, a prima facie case of obviousness exists where the ranges are close but this is a rebuttable presumption. All the Examiner has to do is compare Figure 4 (prior art) and Figure 8 (Applicants' invention) in Applicants' specification to see the difference in properties obtained with Applicants' invention. Thus, Applicants have effectively rebutted the presumption in Titanium Metals Corp. of America.

Regarding the 4 nm thickness of the liner layer, this applies to a liner layer "having a substantially uniform chemical composition." Werkhoven discloses a graded layer composition which contradicts Applicants' claim limitation. The Werkhoven graded layer composition is by definition not "a substantially uniform chemical composition".

Applicants' limitation of the liner material having a "failure temperature greater than 730 degrees Centigrade" is not shown in Applicants' prior art or Werkhoven. The

failure temperature limitation is important in separating those liner layers which will perform acceptably from those that will not.

The Examiner, however, remarks that in "regards to the substantially uniform chemical composition and the failure temperature greater than 730 degrees Centigrade, these limitations are product by process limitations."

Applicants respectfully disagree with the Examiner. These are not product by process limitations at all. The above limitations go to its structure ("substantially uniform chemical composition") and a characteristic of the resulting liner ("failure temperature greater than 730 degrees Centigrade"). These limitations do not pertain in any way to how the liner is actually made, i.e., they are not process limitations. Accordingly, the Examiner has misread these limitations as product by process limitations and they must be given patentable weight in examining the claims.

Regarding claim 3, the liner thickness of less than 2 nm is not shown in the cited combination of Applicants' Prior Art and Werkhoven because Applicants' Prior Art does not disclose this thickness limitation and Werkhoven discloses a graded layer, which is not what Applicants are claiming.

Regarding claim 11, some of this claim's important limitations are there is no liner layer on the bottom of the via, there is only a single liner layer (on the sides of the via), the liner layer "having a substantially uniform chemical composition", the liner layer comprises TaN_X, the liner has a thickness less than 4nm and the liner has a "failure temperature of greater than 730 degrees Centigrade".

Claim 11 is distinguishable from Applicants' Prior Art and Wekhoven in several respects. In Applicants' Prior Art and Werkhoven, the liner covers the bottom of the via as well as the sides; this is different from what Applicants are claiming.

The TaN_X liner layer is a single liner layer, has a thickness of 4 nm and has a substantially uniform chemical composition. Applicants' Prior Art does not disclose liners having this thickness and while Werkhoven may disclose liners having this thickness, they are part of a graded liner composition and thus their composition is not uniform. Any suggestion that Werkhoven may disclose the thin liner layer of claim 11 is further rebutted by the claim limitation that there is only a "single liner layer".

Applicants further claimed the liner layer having a "failure temperature of greater than 730 degrees Centigrade". This limitation is not taught by Applicants' Prior Art or Werkhoven. Again, the failure temperature limitation is important in separating those liner layers which will perform acceptably from those that will not.

That the limitations "having a substantially uniform chemical composition" and "a failure temperature of greater than 730 degrees Centigrade" are not product by process limintations has been shown above with respect to claim 1. Accordingly, these limitations must be given patentable weight in the examination of claim 11.

Regarding claim 12, the tantalum / nitrogen ratio is claimed. It is believed, as noted above, that this range is not disclosed in Applicants' Prior Art or Werkhoven. Any closeness in properties to the prior art has been effectively rebutted by a comparison of Figure 4 (prior art) and Figure 8 (Applicants' invention) in Applicants' specification.

In view of all of the preceding remarks, it is submitted that the Examiner has failed to state a prima facie case of obviousness with respect to claims 1, 3, 11 and 12. Accordingly, these claims must be deemed to be allowable.

II. Claims 6, 7 and 13 have been rejected by the Examiner under 35 USC §103(a) as being unpatentable over Applicants' Prior Art in view of Chen et al. U.S. Patent 6,784,096.

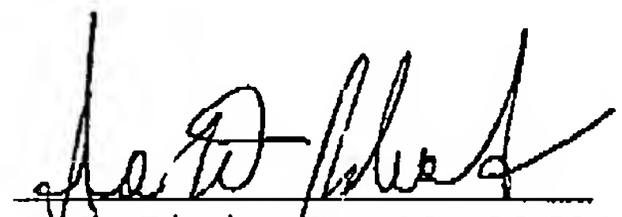
Inasmuch as claims 6 and 7 depend from claim 1 and claim 13 depends from claim 11, and since claims 1 and 11 are believed to be patentable, then claims 6, 7 and 13 should be patentable as well.

No independent ground of patentability is recited for claims 6, 7 and 13 in this Response but rather Applicants are relying on their response in their last Amendment which is incorporated by reference herein.

Summary:

In view of all of the preceding remarks, it is submitted that all of claims 1, 3, 6, 7 and 11 to 13 are in condition for allowance. If the Examiner finds this application deficient in any respect, the Examiner is invited to telephone the undersigned at the Examiner's earliest convenience.

Respectfully Submitted,
Cabral Jr., et al.



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